Stock Assessment Form

Demersal species

2014

[A brief abstract may be added here]

Stock Assessment Form version 0.9

Uploader: Marina Panayotova

Stock assessment form

1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Psetta maxima/Scophthalmus maximus	Black Sea Turbot	31
1st Geographical sub-area:	**2nd Geographical sub-area:**	**3rd Geographical sub-area:**
29		
1st Country	**2nd Country**	**3rd Country**
Bulgaria	Romania	Ukraine
4th Country	**5th Country**	**6rd Country**
Turkey	Russian Federation	Georgia
Stock assessment method: (direct, indirect, combined, none)		
Combined method **Indirect: State-Space Assessment Model (SAM) in FLR environment.** **Direct: Trawl surveys used for tuning**		
Authors:		
STECF EWG 13-12 members: Sampson, D., Ak, O., Daskalov, G., Cardinale, M., Charef, A., Duzgunes, E., Genç, Y., Gucu, A.C., Maximov, V., Mikhaylyuk, A., Orio, A., Osio, G. C., Panayotova, M., Radu, G., Raykov, V.,Shlyakhov, V., Yankova, M. and Zengin, M. STECF members: Casey, J., Abella, J. A., Andersen, J., Bailey, N., Bertignac, M., Cardinale, M., Curtis, H., Daskalov, G., Delaney, A., Döring, R., Garcia Rodriguez, M., Gascuel, D., Graham, N., Gustavsson, T., Jennings, S., Kenny, A., Kirkegaard, E., Kraak, S., Kuikka, S., Malvarosa, L., Martin, P., Motova, A., Murua, H., Nord, J., Nowakowski, P., Prellezo, R., Sala, A., Scarcella, G., Somarakis, S., Stransky, C., Theret, F., Ulrich, C., Vanhee, W. & Van Oostenbrugge, H.		
Affiliation:		
European Commission EUR 26228 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen Title: Scientific, Technical and Economic Committee for Fisheries - Assessment of Black Sea stocks (STECF-13-20). Luxembourg: Publications Office of the European Union 2013 – 429 pp. – 21 x 29.7 cm EUR – Scientific and Technical Research series – ISSN 1831-9424 (online), ISSN 1018-5593 (print) ISBN 978-92-79-33772-7 doi:10.2788/34535		

The ISSCAAP code is assigned according to the FAO 'International Standard Statistical Classification for Aquatic Animals and Plants' (ISSCAAP) which divides commercial species into 50 groups on the basis of their taxonomic, ecological and economic characteristics. This can be provided by the GFCM secretariat if needed. A list of groups can be found here:

http://www.fao.org/fishery/collection/asfis/en

Direct methods (you can choose more than one):

- Acoustics survey
- Egg production survey
- Trawl survey

Indirect method (you can choose more than one):

- ICA
- VPA
- LCA
- AMCI
- XSA
- Biomass models
- Length based models
- Other (please specify)

Combined method: you can choose both a direct and an indirect method and the name of the combined method (if it does exist)

2 Stock identification and biological information

Turbot (*Psetta maxima/Scophthalmus maximus*) is a demersal species and occurs in local shoals all over the shelf area of all Black Sea countries at depths up to 100m - 140m . Species inhabits different habitats, but mostly on sandy and silty bottoms and mussel beds. The reproduction occurs during the spring season – between April and June. Turbot in the Black Sea is represented by several local populations, which migrate and mix in the adjacent zones. Local populations are independent units of the stock, and have to be covered in order to ensure an accurate assessment of the stock at regional level. The gaps in available information regarding distribution of different stock unit, accurate fisheries statistics, estimates of discards and by-catch, availability of biological data and share of IUU fisheries continue to exist. The present assessment is based on the analysis of the best available information, obtained from combined data of all Black Sea countries and assuming the stock as representing a single unit in the entire Black Sea.

2.1 Stock unit

The stock assessment assumed that all turbot in the Black Sea are part of a single stock, but some members of the Working Group questioned the validity of this assumption. The Group was not provided with strong evidence either that there are multiple stocks of turbot in the Black Sea or that there is a single stock.

2.2 Growth and maturity

Turbot is a long living species with a slow growth rate. The parameters reported here by countries are considered appropriate for the description of an average growth performance of the species in GSA 29 – Tab. 2.2.1.

Table 2.2-1. Growth parameters of turbot by countries and periods (Source: Sampson et.al., 2013).

COUNTRY	AREA	YEAR_PERIOD	SPECIES	SEX	L_INF	K	t_0	*a*	*b*
BGR	29	2012	TUR	C	88.44	0.17	-0.34	0.0000338	2.86
RO	29	2012	TUR	C	86.32	0.2179	-0.486	0.03502439	2.842
TR	29	2012	TUR	C	82.41	0.342	-3.73	0.012	3.09

Table 2.2-2. Common maturity ogive of turbot by ages and years (Source: Sampson et.al., 2013).

Year/Age	1	2	3	4	5	6	7	8	9	10+
2012	0	0.13	0.52	0.92	1	1	1	1	1	1

Table 2.2-1:Maximum size, size at first maturity and size at recruitment.

Somatic magnitude measured (LH, LC, etc)*		**Units***	

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed					Reproduction season	
Size at first maturity					Reproduction areas	
Recruitment size					Nursery areas	

Table 2.2-2: Growth and length weight model parameters

			Sex			
		Units	**female**	**male**	**both**	**unsexed**
Growth model	**L_∞**					
	K					
	t_0					
	Data source					
Length weight relationship	**a**					
	b					
	M (vector by length or age)					

sex ratio (% females/total)	

3 Fisheries information

3.1 Description of the fleet

This information should be consistent with the information provided in Task 1. In later versions of the stock assessment form, the tables will be pre-filled with the information from Task 1 and participants have to check for differences and report them. Also the SCSI recommends that fishing gears of the different operational units are described in detail (e.g. mesh size, etc.)

Same codes as in previous assessment forms should be used.

Table 3.1-1: Description of operational units in the stock

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	Bulgaria	29	LOA > 0 < 6 LOA => 6<12 LOA => 12<18 LOA => 18<24 LOA => 24<40	GNS	Demersal	Turbot
			LOA => 12<18 LOA => 18<24 LOA => 24<40	OTM	Pelagic	Turbot
Operational Unit 2	Romania	29	LOA > 0 < 6 LOA => 6<12 LOA => 12<18 LOA => 18<24 LOA => 24<40	GNS	Demersal	Turbot
Operational Unit 3	Turkey	29	4 – 23 m	GNS	Demersal	Turbot
			12 – 28 m	Trawl vessels	Demersal	Turbot
Operational Unit 4	Ukraine	29	Not reported	Not reported	Demersal	Turbot
Operational Unit 5	Russian Federation	29	Not reported	Not reported	Demersal	Turbot
Operational Unit 6	Georgia	29	Not reported	Not reported	Demersal	Turbot

Table 3.1-2: Catch, bycatch, discards and effort by operational unit in 2012

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
Bulgaria		tons	36.44	Not reported	Not reported	Not reported	CPUE, kW days at sea
Romania		tons	43.2	Not reported	Not reported	Not reported	CPUE, kW days at sea
Turkey	362	tons	172.2	Not reported	Not reported	Not reported	CPUE ($kg.h^{-1}$)
Ukraine		tons	240.9	Not reported	Not reported	Not reported	-
Russia		tons	35.3	Not reported	Not reported	Not reported	-
Georgia		tons	0	Not reported	Not reported	Not reported	-
Total			528				

Table 3.1-3: Catches as used in the assessment

Classification	Catch (tn)	IUU catch (tn)
1950	3932	
1951	4741	
1952	5217	
1953	4985	
1954	4505	
1955	3678	
1956	3623	
1957	3017	
1958	4289	
1959	4653	
1960	2680	
1961	3058	
1962	2904	
1963	3812	
1964	3666	
1965	3063	

Classification	Catch (tn)	IUU catch (tn)
1966	3093	
1967	2709	
1968	2931	
1969	3076	
1970	5273	
1971	3052	
1972	3049	
1973	3705	
1974	1696	
1975	1273	
1976	1584	
1977	2012	
1978	2160	
1979	5447	
1980	2843	
1981	3276	
1982	4662	
1983	5307	
1984	2852	
1985	527	
1986	428	
1987	849	
1988	1116	
1989	1460	
1990	1393	
1991	935	
1992	439	
1993	1603	
1994	2144	
1995	2943	
1996	2048	
1997	1025	
1998	1588	
1999	1953	
2000	2789	
2001	2557	
2002	618	1412
2003	424	943
2004	434	989
2005	741	2039
2006	967	2737

Classification	Catch (tn)	IUU catch (tn)
2007	1035	2692
2008	816	1901
2009	731	1541
2010	622	1321
2011	486	887
2012	528	963
Total		

3.2 Historical trends

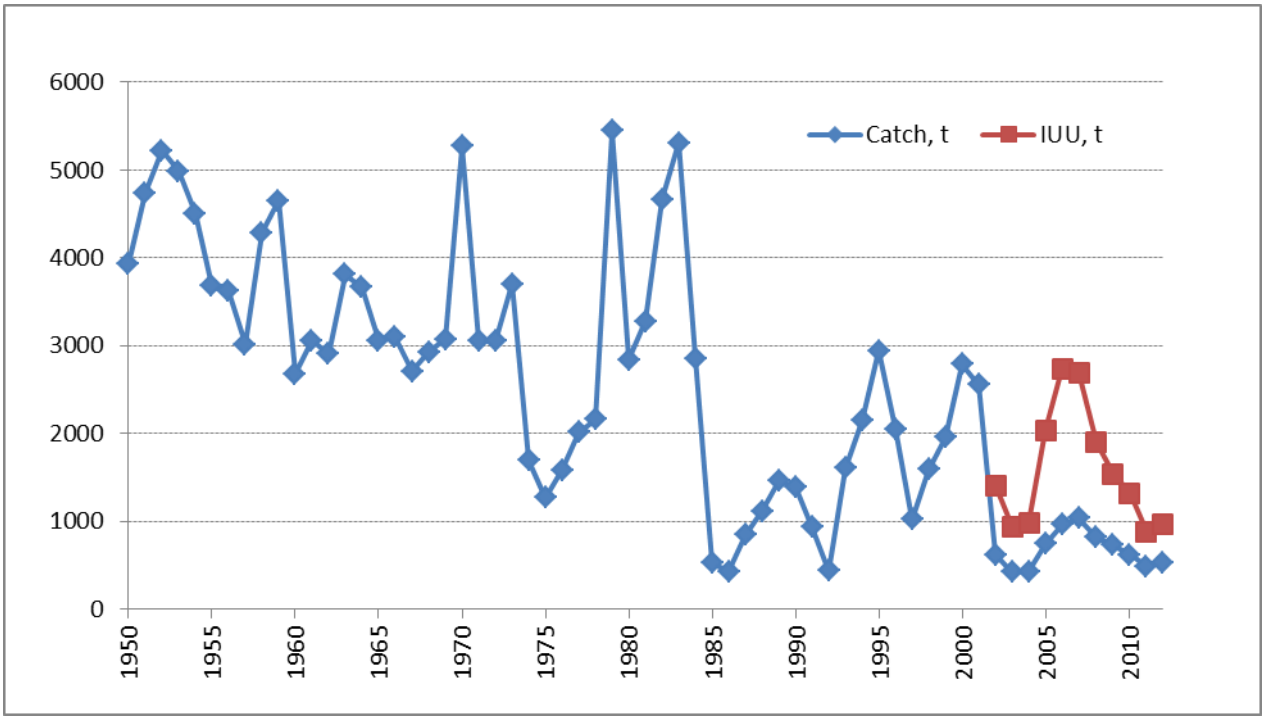


Figure 3.2-1. Landings and IUU estimates of turbot in the Black Sea during the period 1950 – 2012. The IUU estimated refers to the total estimated catches including unreported landings.

3.3 Management regulations

Turbot fisheries in Black Sea EU waters are being managed through the annual establishment of fishing opportunities (EU quotas) since 2008, by the adoption of Council Regulations . During the last three years, the EU turbot quota has been fixed at 86.4 t and allocated to Bulgaria and Romania (50 % each). The same Council Regulations set up every year the prohibition of fishing activities during reproduction period for turbot has been in force from 15 April to 15 June in European Community waters of the Black Sea. It has to be noticed that the same period of prohibition is fixed by Turkish National Legislation.

During the 37 Session of the General Fisheries Commission for the Mediterranean (GFCM), a recommendation to establish a set of minimum standards for Turbot fisheries in the Black Sea was adopted. This recommendation, set up minimum conservation size (45 cm) for turbot and minimum mesh size (400 mm) for gillnets. It has to be noticed that these measures were already in place in Turkey and the EU.

In Turkey, turbot fisheries have been traditionally conducted by bottom set gill nets with minimum mesh size of 320-400 mm (Tonay, Öztürk, 2003) and by bottom trawls - with minimum mesh size 40 mm. However the above mentioned GFCM recommendation

establishes gillnets as the only gear allowed to fish turbot in the Black Sea.

Though some violations, turbot fishery is conducted along offshore waters starting from 3 miles from coast to 9.7 miles. Fishing depth ranges between 25 m and 100 m. The catches are highest within depths of 50-60 m. The basic management criteria for turbot fisheries in 2012-2014 announced by Commercial Fishery Advice of General Directorate of Fishery in Turkey are summarized below (Anonim, 2012):

- Area closures: Bottom trawling is prohibited in the areas between 1) Sinop city, İnceburun (42° 05.959' N-34° 56.695'E and Samsun city Çayağzı cape (41° 41.040' N-35° 25.193' E), 2) Ordu city; Ünye, Taşkana cape (41° 08.725' N-37° 17.531' 4) and Georgia border. Furthermore, it is also banned within 2 miles from land between Zonguldak city; Ereğli, Baba cape (41° 17.342' N-31° 23.937'E) and Bartın city; Amasra, Tekke cape (41° 43.485' N-32° 19.258' E) (Fig.3.3-1). In the rest of the areas, the waters open for trawling are 3 miles from the coast.

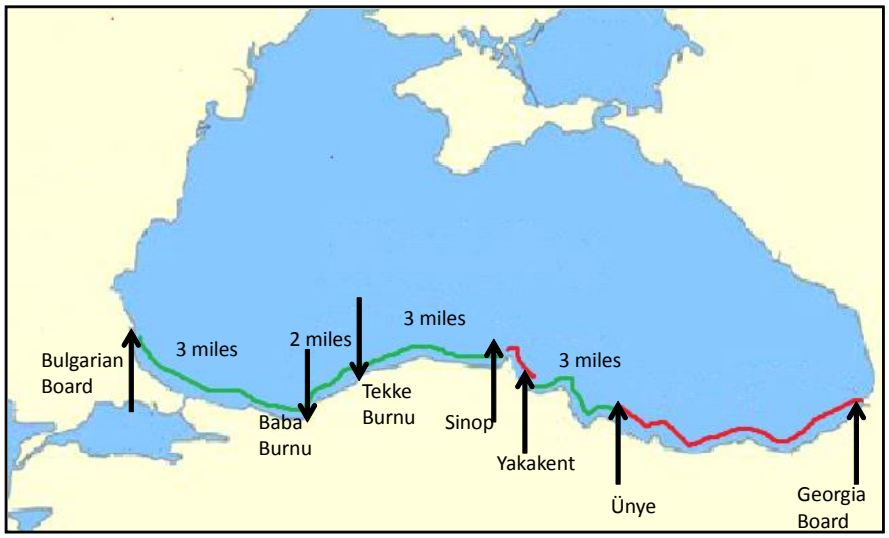


Figure 3.3-1. Area closures and distance limitations for bottom trawling along the Turkish coast (Green lines: open areas, red lines: area closures).

- Time closures: In open areas, bottom trawling for turbot is banned between 15 April and 15 September. Turbot fishery by gillnet is allowed except during the period 15 April – 15 June.
- Mesh size limitations: a) Mesh size of the codend should not be lower than 40 mm for bottom trawl nets. b) Mesh size of gillnets should not be lower than 400 mm. c) Long lines and trammel gillnets are forbidden for turbot fishery.
- Minimum legal catch size: Minimum legal size (total length) is determined as 45 cm for all fishing gears.

In Ukraine turbot fisheries are conducted with bottom (turbot) gill nets with mesh size 360 - 400 mm. The use of bottom trawls has been prohibited. Turbot exploitation in Ukraine has been regulated by TACs since 1996.The Ukranian TAC for turbot in 2012 was 430 tons.

The Regulations of Fisheries in Ukraine determine the following standards regulating the fisheries of the Black Sea turbot:

- minimum commercial fishing size – 35 cm (SL);
- allowable by-catch of its juveniles – during the non-target fisheries not more than 2% of total catch weight, during the target fisheries with nets (with mesh size 360 mm) not more 5% by counting;
- during target long-lining of picked dogfish and Rajiformes by-catch of turbots is allowed, at the amount of not more than 20% of its juveniles by counting;
- turbot by-catch is allowed in trawl catches of sprat not more than 4 individuals a commercial fishing length per one ton of catch;
- in the period of abundant spawning of turbot in the coastal 12-mile zone a temporal prohibition for 15 – 30 days is implemented for harvesting of fish with trawls, net and long-lines (such prohibition applies to different zons at diiferent periods depending on the maturity of fish)).
- the fishing effort on turbot is limited to 7 700 gillnets(100 m each). For small vessels the minimum number of gillnets is 20. For registered vessels is 100 units.

3.4 Reference points

Table 3.4-1: List of reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	4080 2914		Bpa Blim		
SSB					
F	0.26		Fmsy		
Y					
CPUE					

4 Fisheries independent information

4.1. International (Bulgarian and Romanian) Bottom Trawl Survey

Fill in one section for each of the direct methods used. The name of the section should be the name of the direct method used.

4.1.1 Brief description of the chosen method and assumptions used

Demersal trawl surveys in Community waters (Bulgaria and Romania) were executed in accordance with national Data collection programs of Bulgaria and Romania for 2012. Surveys were aimed to assess the turbot abundance and biomass indices. Two of them were executed in Romanian Black Sea area in spring and autumn seasons and one - in Bulgarian marine area. All studies from 2010 up to date in EU waters are performed with the same vessel and equipment.

Bulgarian surveys are designed according to the standard methodology for stratified random sampling (Sparre, Venema, 1998; Sabatella, Franquesa, 2004) and swept area method. The method is based on bottom trawling across the seafloor (area swept) and is widely used as a direct method for demersal fish stock assessment when only an index of abundance is required. The seabed area covered during a single haul represents a basic measurement unit, which although very small compared to the total study area is deemed representative since turbots do not aggregate in dense assemblages. The fields are grouped in larger sectors – so called strata, with geographic and depth boundaries selected according to the density distribution of the species. The research area was divided in four strata according to depth: Stratum 1 (15 – 35 m), Stratum 2 (35 – 50 m), Stratum 3 (50 – 75 m) and Stratum 4 (75 – 100 m).

Direct methods: trawl based abundance indices

Table 3.4-1: Trawl survey basic information – Bulgaria, 2012

Survey	Demersal trawl survey	**Trawler/OV**	Rv “Steaua di Mare I”
Sampling season	Spring		
Sampling design	Stratified sampling (15 – 35m, 35 – 50m, 50-75m, 75 – 100m)		
Sampler (gear used)	Demersal trawl (22/27 -34)		
Cod –end mesh size as opening in mm	10 mm		
Investigated depth range (m)	15 – 100 m		

Table 3.4-2: Trawl survey sampling area and number of hauls- Bulgaria, 2012

Stratum	Total surface (km^2)	Trawlable surface (km^2)	Swept area (km2)	Number of hauls
15 – 35 m	938.69	-	0.5635	5
35 – 50 m	1814.80	-	0.867	10
50 – 75 m	2753.49	-	0.554	15
75 – 100 m	2503.18	-	0.289	10
Total (15 – 100 m)	8010.16		2.273	40

The biomass of the main fish species with commercial value along Romanian Black Sea coast was asessed by swept area method. During the research survey in spring season, the turbot population was wide distributed in the area between Mangalia and Sulina, with a higher density between Vama Veche – Constanta. The agglomerations reached an average value of 0.108 - 167 t/nm2 (Maximov et al, 2012).

Table 3.4-3: Trawl survey basic information - Romania

Survey	Demersal trawl surveys	**Trawler/OV**	Rv "Steaua di Mare I"
Sampling season	Spring, Autumn		
Sampling design	Stratified sampling (0 – 30 m, 30 – 50m, 50-70m)		
Sampler (gear used)	Demersal trawl (22/27 -34)		
Cod –end mesh size as opening in mm	10 mm		
Investigated depth range (m)	0 – 70 m		

Table 3.4-4: Trawl survey sampling area and number of hauls- Romania, Spring 2012

Stratum	Total surface (km^2)	Trawlable surface (km^2)	Swept area (km2)	Number of hauls
0 – 30 m	2279.064		0.264	11
30 – 50 m	3657.519		0.336	14
50 – 70 m	1776.790		0.360	15
Total (0 – 70 m)	7713.38		0.960	40

Table 3.4-5: Trawl survey sampling area and number of hauls- Romania, Autumn 2012

Stratum	Total surface (km^2)	Trawlable surface (km^2)	Swept area (km2)	Number of hauls
0 – 30 m	2087.190		0.168	7
30 – 50 m	3195.607		0.360	15
50 – 70 m	3494.390		0.384	16
Total (0 – 70 m)	8777.187		0.912	38

Table 3.4-6: Trawl survey abundance and biomass results - Bulgaria

Stratum	Years	kg per km²	CV or other	Relative * biomass, kg All age groups	CV or other	N per km²	CV or other	Relative * abundance All age groups	CV or other
15 – 35 m	2012	17.86	1.033	16764.37	1.03	20.77	1.03	19492.86	0.97
35 – 50 m	2012	40.89	1.446	74212.66	1.45	13.84	1.45	25124.13	1.35
50 – 75 m	2012	26.59	1.559	73223.19	1.56	9.23	1.56	25423.00	1.35
75 – 100 m	2012	10.90	2.215	27290.83465	2.22	6.92	2.22	17326.98	2.29
Total (15 – 100 m)				191491.05				87366.98	

* with catchability coefficient assumed =1

Table 3.4-7: Trawl survey abundance and biomass results – Romania, Spring 2012

Stratum	Years	kg per km²	CV or other	Relative * biomass, t All age groups	CV or other	N per km²	CV or other	Relative * abundance All age groups	CV or other
15 – 35 m	2012	76.67	1.239	94.28	1.239				
35 – 50 m	2012	90.17	1.392	178.648	1.392				
50 – 75 m	2012	58.31	1.774	56.051	1.774				
75 – 100 m	2012	-	-	-					
Total (15 – 100 m)				**328.98**					

* with catchability coefficient assumed =1

Table 3.4-8: Trawl survey abundance and biomass results – Romania, Autumn 2012

Stratum	Years	kg per	CV or	Relative *	CV or	N per	CV or	Relative *	CV or

		km²	**other**	**biomass, t** **All age groups**	**other**	**km²**	**other**	**abundance** **All age groups**	**other**
15 – 35 m	2012	30.23	1.634	34.07	1.634				
35 – 50 m	2012	79.37	2.228	137.06	2.228				
50 – 75 m	2012	48.05	1.542	91.06	1.542				
75 – 100 m	2012	-	-		-				
Total (15 – 100 m)				**262.19**					

* with catchability coefficient assumed =1

Comments

- Specify the other index of variability of mean
- Specify sampling design (for example random stratified with number of haul by stratum proportional to stratum surface; or systematic on transect;…)

Direct methods: trawl based length/age structure of population at sea

Table 3.4-8: Trawl survey slicing method

Survey		**Trawler/RV**	
Total area (km^2)			
Age slicing method			
Maturity scales (females and males)			

Table 3.4-9: Trawl survey results by length or age class - Bulgaria

N (x10^3, Total or sex combined) by Length or age class	**Year**		
	2012	**….**	**…..**
Age class			
2	9.854		
3	19.707		
4	26.277		
5	13.138		
6	9.854		
7	6.569		
Total			

Table 3.4-10: Trawl survey results by length or age class - Romania

N ($x10^3$,Total or sex combined) by Length or age class	**Year**		
	2012	**….**	**…..**
Age class			
2	9.854		
3	19.707		
4	26.277		
5	13.138		
6	9.854		
7	6.569		
Total			

Comments

- Specify if numbers are per km^2 or raised to the area, assuming the same catchability .
- Specify the ageing method or the age slicing procedure applied, specify the maturity scale used.
- In case maturity ogive has not been estimated by year, report information for groups of years.
- Possibility to insert graphs and trends

Direct methods: Trawl based mortality rates

Table 3.4-3: Trawl survey methods for the estimation of mortality rates

Survey		**Trawler/RV**	

Z estimation	Report formula, or method and/or reference
F estimation	Report formula, or method and reference
M estimation	Report value (if scalar), formula, or method and reference

Note: In case of average mortalities specify the age class, specify the age class included

Table 3.4-4: Trawl survey; method for natural mortality estimates

M by age per Survey	**Report formula, or method and reference**				
	Age 0	**Age 1**	**Age 2**	**Age 3**	**etc**
Year					

Table 3.4-5: Trawl surveys; total mortality estimate

Years	Total mortality rates (Z)	Years	Total mortality rates (Z)	years	Total mortality rates (Z)
Year					

Table 3.4-6: Trawl surveys; fishing mortality estimates

Years	Fishing mortality rates (F)	Survey	Fishing mortality rates (F)	Survey	Fishing mortality rates (F)
Year					

Table 3.4-7: Trawl surveys; total mortality estimates by age

Z by age per Survey	Age 0	Age 1	Age 2	Age 3	etc
year					

Table 3.4-8: Trawl surveys; fishing mortality estimates by age

F by age per Survey	Age 0	Age 1	Age 2	Age 3	etc
year					

Direct methods: trawl based Recruitment analysis

Table 3.4-9: Trawl surveys; recruitment analysis summary

Survey		**Trawler/RV**	
Survey season			
Cod –end mesh size as opening in mm			
Investigated depth range (m)			
Recruitment season and peak (months)			
Age at fishing-grounds recruitment			
Length at fishing-grounds recruitment			

Table 3.4-10: Trawl surveys; recruitment analysis results

Years	**Area in km^2**	**N of recruit per km^2**	**CV or other**	**Relative recruitment (N of individuals)**	**CV or other**

Comments

- Specify type of recruitment:
  - continuous and diffuse
  - discrete and diffuse
  - discrete and localised
  - continuous and localised.

- Specify the method used to estimate recruit indices

- Regarding the relative recruitment and the total number of individuals be consistent with the raising procedure adopted in the Sheet TS1

- Specify if the area is the total or the swept one

- Possibility to insert graphs and trends

Direct methods: trawl based Spawner analysis

Table 3.4-11: Trawl surveys; spawners analysis summary

Survey		**Trawler/RV**	
Survey season			
Investigated depth range (m)			
Spawning season and peak (months)			

Table 3.4-12: Trawl surveys; spawners analysis results

Surveys	**Area in km²**	**N (N of individuals) of spawners per km²**	**CV or other**	**SSB per km²**	**CV or other**	**Relative SSB**	**CV or other**

Comments

- Specify type of spawner:
  - total spawner
  - sequential spawner
  - presence of spawner aggregations

- Regarding the total number of individuals and biomass be consistent with the raising procedure adopted in the Sheet TS1

- Specify if the area is the total or the swept one

Possibility to insert graphs e trends

4.1.2 Spatial distribution of the resources

Include maps with the results of the direct method distribution

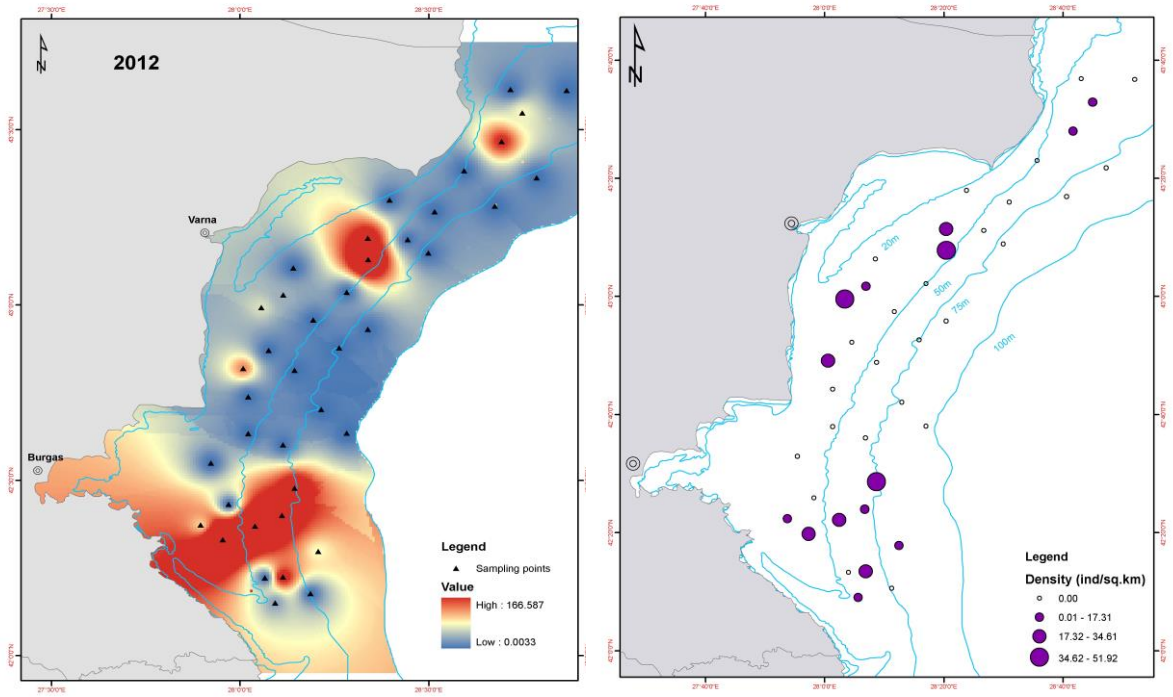


Figure 4.1.2-1. Distribution of turbot CPUA (kg/km2) and density, obtained from research survey along the Bulgarian Black Sea coast in May 2012 (Panayotova, Raykov , 2013).

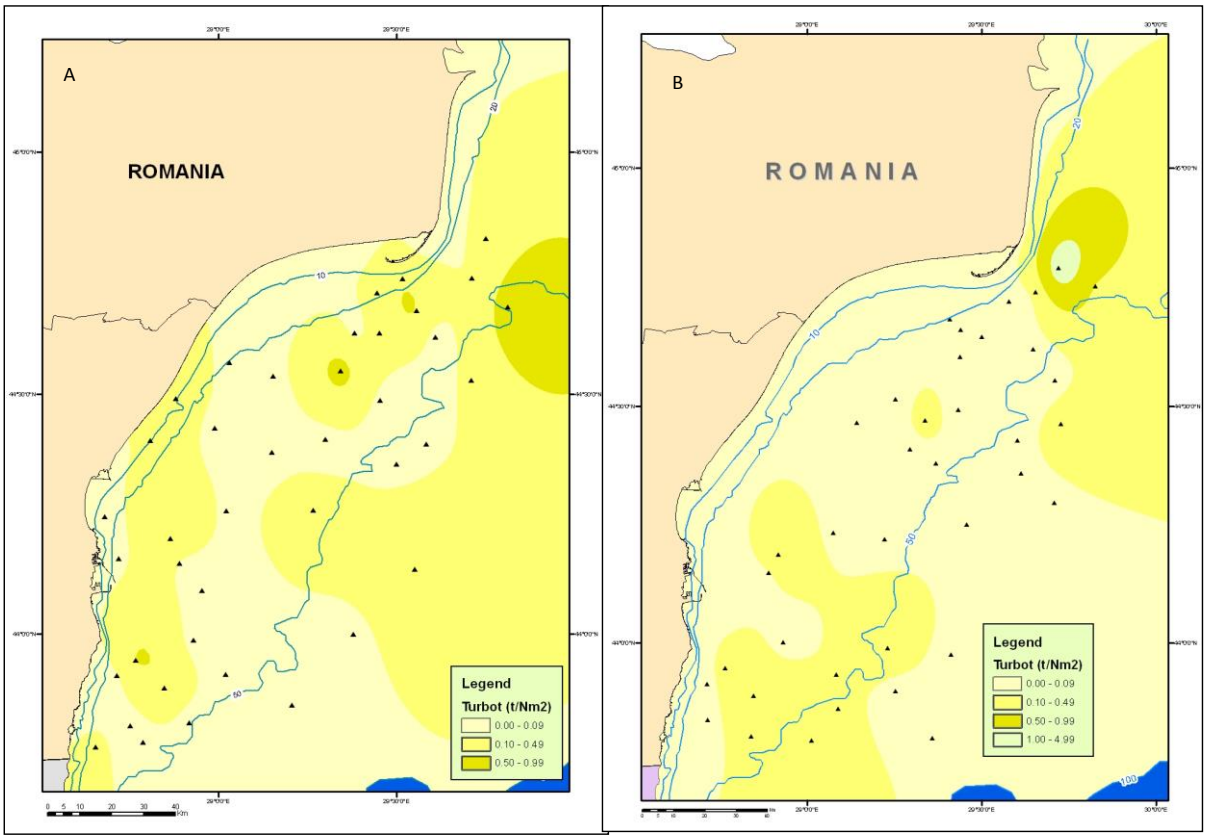


Figure 4.1.2-2. Distribution of turbot CPUA (kg/Nm2) from surveys along the Romanian Black Sea coast in spring (A) and autumn (B) seasons of 2012 (Maximov et.al, 2012).

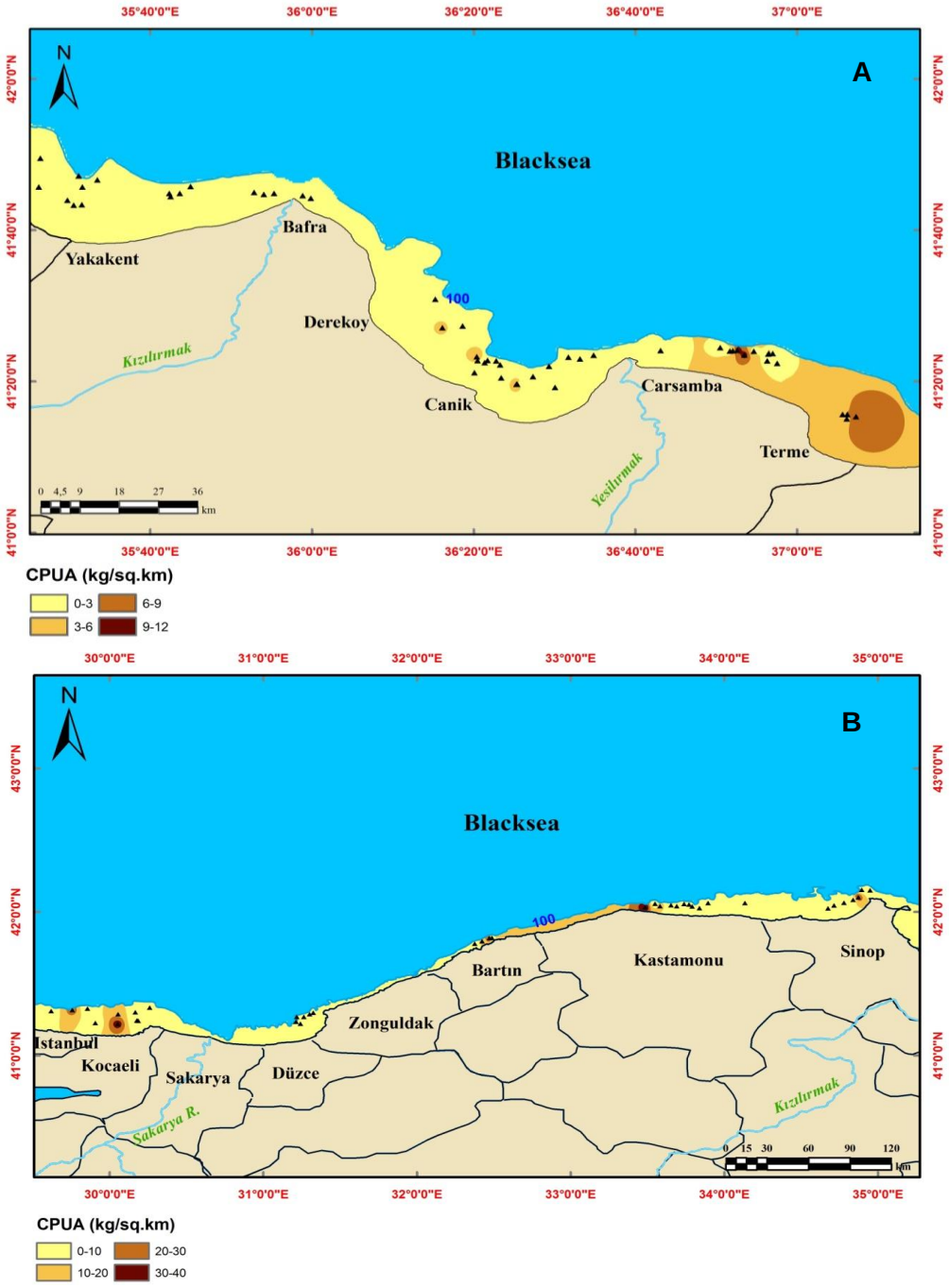
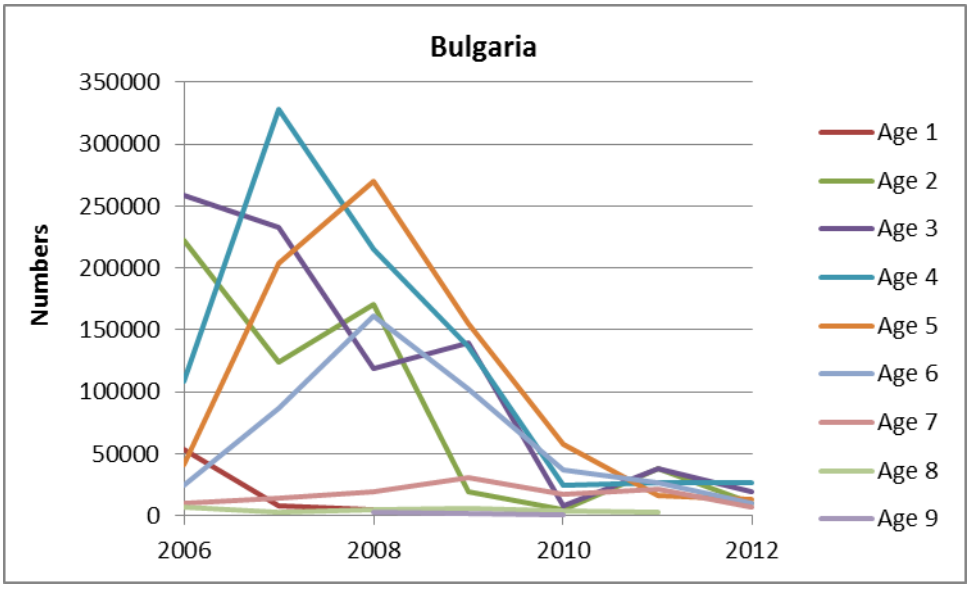


Figure 4.1.2-3. Distribution of turbot CPUA (kg.km-2) from surveys along the Turkish East (A) and West (B) Black Sea coast in 2012 (Zengin, Gumus, 2013).

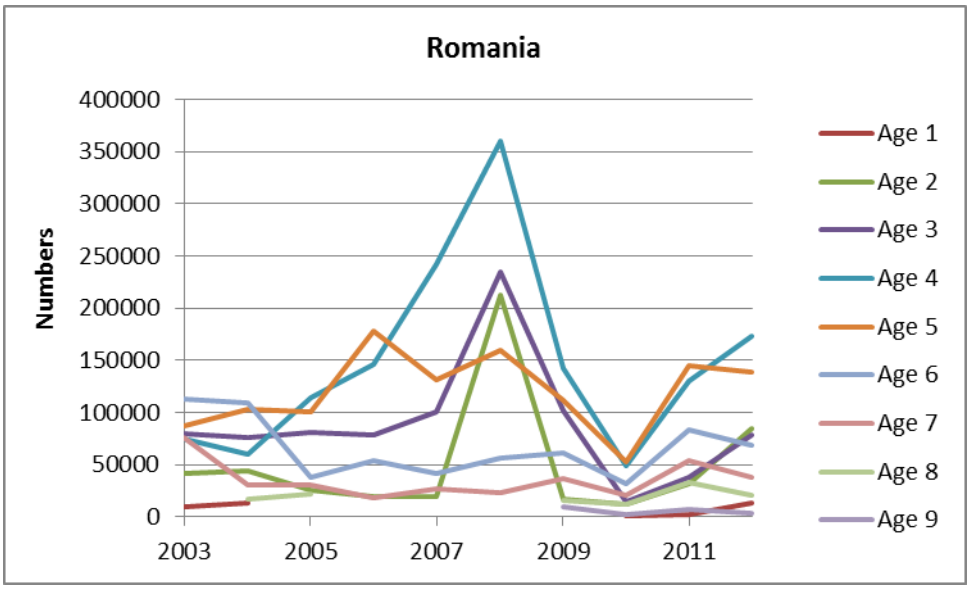
4.1.3 Historical trends

Figure with the observed trends in abundance, abundance by age class, etc. for each of the directed methods used.

Table with the raw data used for the figures above should also be provided and revised yearly.



4.1.3-1. Observed trends in abundance by age class during demersal surveys in front of Bulgarian Black Sea coast, 2006 – 2012.



4.1.3-2. Observed trends in abundance by age class during demersal surveys in front of Romanian Black Sea coast, 2003 – 2012.

5 Ecological information

5.1 Protected species potentially affected by the fisheries

A list of protected species that can be potentially affected by the fishery should be incorporated here. This should also be completed with the potential effect and if available an associated value (e.g. bycatch of these species in tn)

Marine mammals

Delphinus delphis

Phocoena phocoena

Tursiops truncatus

The by-catch of other non-target species (R. clavata, S. acanthias, Acipenser spp., cetaceans) in turbot fishing gear could be significant. Along the Turkish Black Sea coast, about 3000 *P. phocoena* and 1500 *T. truncatus* were by-caught annually (TUDAV, 1999; Birkun, 2002). In 2010-2011 during the most intense turbot fishing season (April-July) direct recording of cetacean bycatches in bottom set gillnets was conducted in the central Bulgarian area. (GFCM, 2011). The bycatch index of *P. phocoena* was estimated at 22 per 100 km net set and that of *T. truncatus* – 2 per 100 km net set or overall 24 cetaceans per 100 km net set. (GFCM, 2011). However, there are no enough studies on the by-catch and discards rates of species in fishing gears, dedicated to turbot fisheries in the Black Sea.

5.2 Environmental indexes

If any environmental index is used as i) a proxy for recruitment strength, ii) a proxy for carrying capacity, or any other index that is incorporated in the assessment, then it should be included here.

Other environmental indexes that are considered important for the fishery (e.g. that may affect catchability, etc.) can be reported here.

No indexes available.

6 Stock Assessment

In this section there will be one subsection for each different model used, and also different model assumptions runs should be documented when all are presented as alternative assessment options.

6.1 SAM

6.1.1 Model assumptions

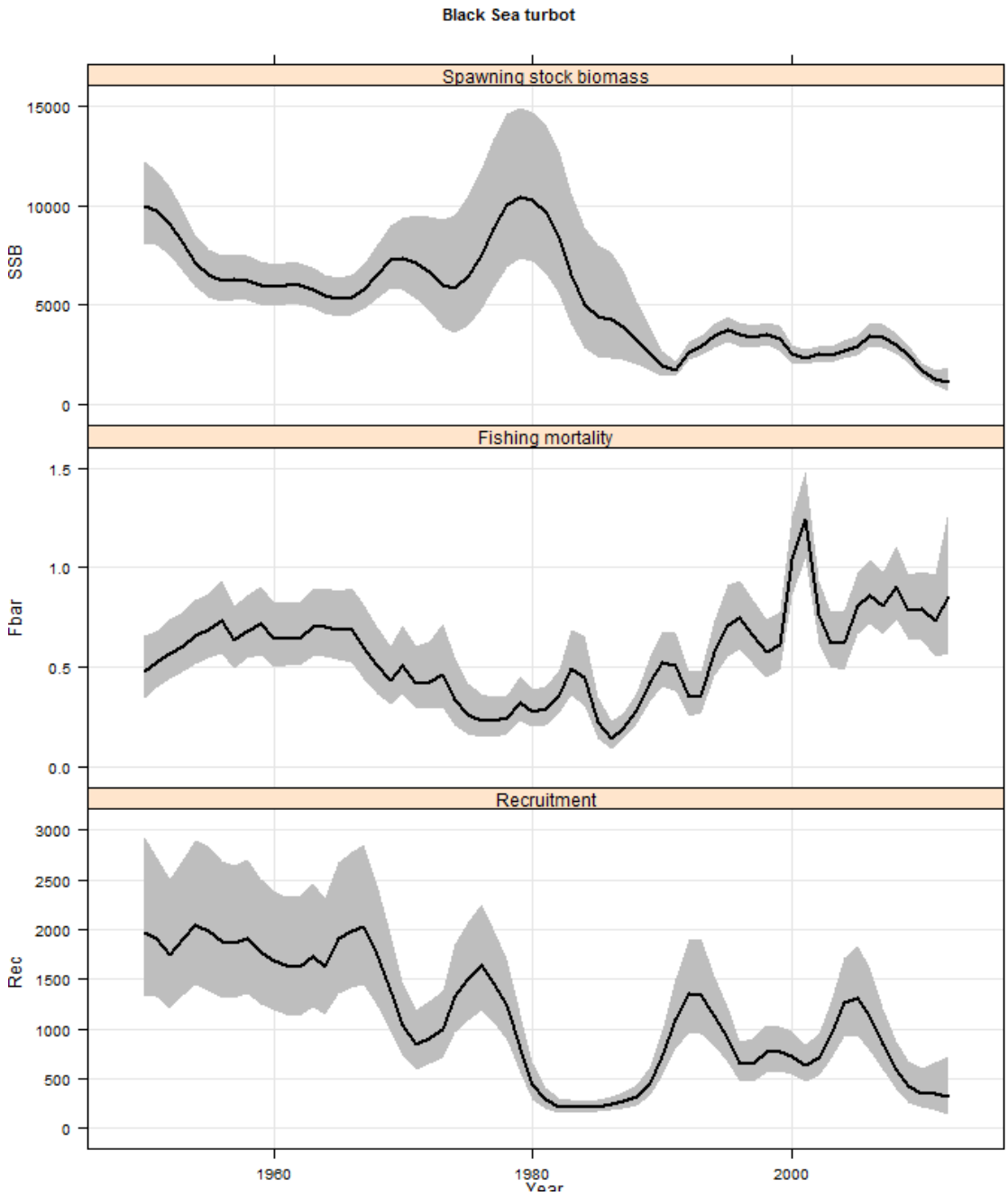
The data set for the period 1950-2012 was compiled using the historical data sources (Ivanov, Beverton, 1985; Ivanov, Karapetkova, 1979; Prodanov et. al, 1997, Daskalov et.al, 2012) and new data for 2012. Available data of total landings, catch at ages, weights and maturity at age are considered appropriate for assesseng the stock using the state-space assessment model (SAM) (Nielsen et al., 2012) in FLR environment. The SAM environment is encapsulated into the Fisheries Library in R (FLR) (Kell et al., 2007) in the form of the package "FLSAM". The state-space assessment model (SAM) is an assessment model which is used for several assessments within ICES and it has been used for the assessment of Black Sea turbot in 2012. The model allows selectivity to evolve gradually over time. It has fewer model parameters than full parametric statistical assessment models, with quantities such as recruitment and fishing mortality modelled as random effects. All assessments are performed with version 0.99-3 of FLSAM, together with version 2.5 of the FLR library (FLCore). Five tuning series (4 surveys and 1 commercial CPUE series were compiled from previous assessments (Daskalov et al., 2012) and recent data. In 2012, an historical survey covering the Eastern part of the Ukranian Black Sea area was compiled and used in the assessment.

6.1.2 Scripts

If a script is available which incorporates the stock assessment run (e.g. if using FLR in R) it should be provided here in order to create a library of scripts.

6.1.3 Results

Historical figures of SSB, Recruitment, F or other outcomes of the stock assessment model



6.1.3-1. Time-series of population estimates of Black Sea turbot (SAM final model): SSB, F (ages 4–8) and recruitment with estimate of uncertainty.

The SAM estimated recruitment has four peaks in 1965 – 1968, 1974 – 1977,1991 – 1994 and 2003 – 2006 and three lows in 1982-85, 1996 – 1997 and 2004 - 2006. Correspondingly, SSB attained higher values up to 14 255 t in 1976 – 1982 and very low values after 1989. For the recent period however the STECF EWG 13 12 Black Sea assessments is aware that misreporting of actual catches might be larger than assumed in the assessment (around 1.82 the official catches) especially for Bulgaria and Ukraina. Fishing mortality F4-8 has a peak of F~1.25 in 2000-2001 and keeps as high as F = 0.6 - 0.86 thereafter.

6.2 Robustness analysis

Retrospective analysis, comparison between model runs, etc.

Retrospective analysis suggests that the assessment method gives a consistent perception of the stock and its dynamics (Figure 6.2-1). A stable uncertainty associated to the model parameters was estimated for all the retrospective runs. The uncertainty of the estimated values for the main stock parameters is generally lower than 0.3 (Figure 6.2-2). The retrospective runs consistently overestimate SSB and recruitment but has no particular trend in fishing mortality.

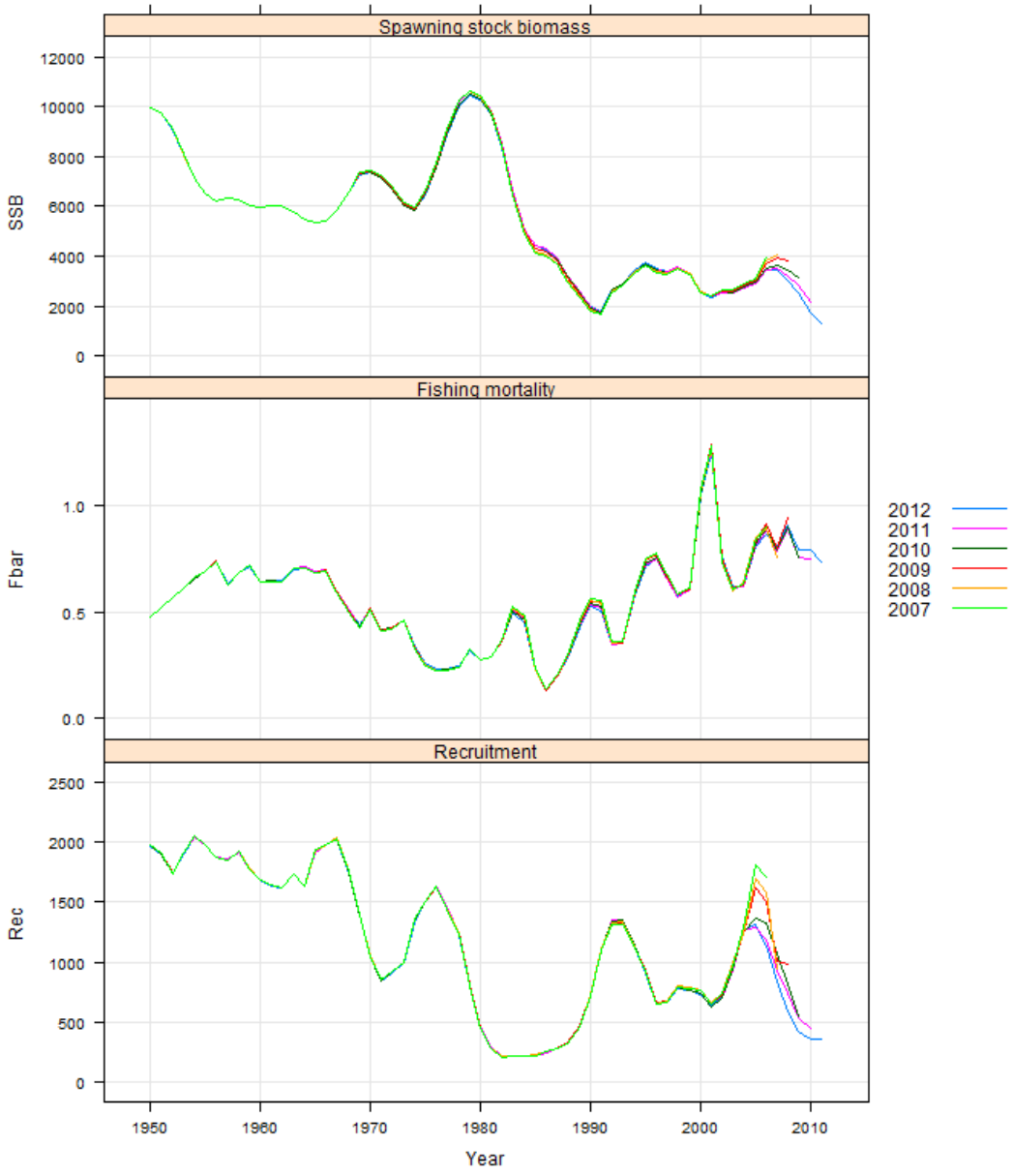


Figure 6.2-1. Black Sea turbot. Final run. Analytical retrospective pattern over years, in the assessment for spawning stock biomass, recruitment and mean fishing mortality in the ages 3-6 ringer. The shaded area shows 95% CI on the final assessment.

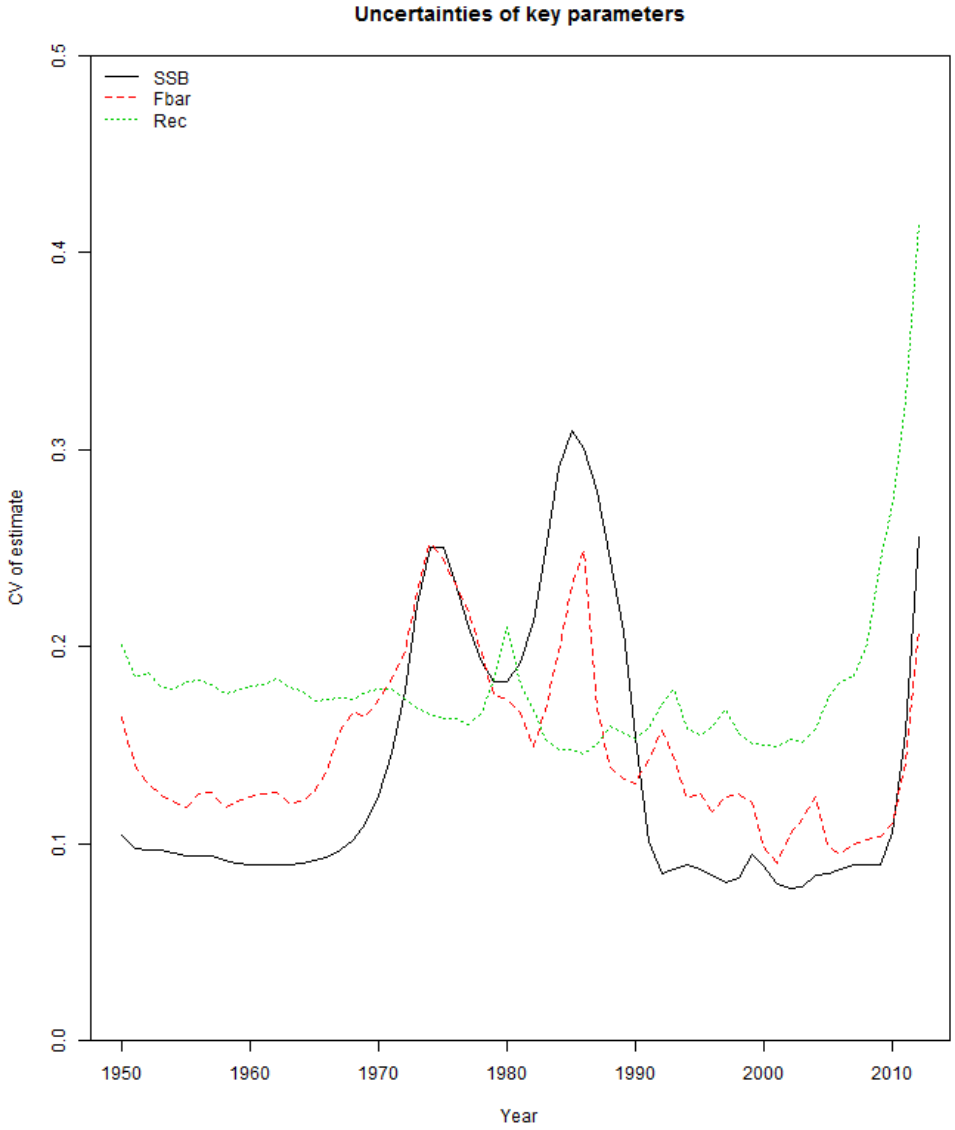


Figure 6.2-2. Black Sea turbot. Final run. Coefficient of variation (CV) of the main stock parameters.

6.3 Assessment quality

Stability of the assessment, evaluation of quality of the data and reliability of model assumptions.

The available data for turbot stock assessment in 2013 is considered good enough in order to perform a reliable assessment of the stock. The share of IUU fisheries by countries was not reported but it was estimated and included in the catches. No data were provided by countries regarding the discards.

After careful examination of the model diagnostics, the working group considered to constrain the estimation of the fishing mortality for the oldest age groups (age 8+) to provide a sound estimation of the correlation parameter in the random walk on F. This resulted in a

sensible improvement in the model stability and suggested the use of additional coupling in some of the catch-related variance parameters. Estimation of all the parameters and their associated uncertainty has also been largely improved – i.e. more stable uncertainty estimate in the final run (as well as in the retrospective analysis), no cross-correlation among the parameter estimates (Figure 6.3-1). Thus, the revised settings have been used throughout this assessment.

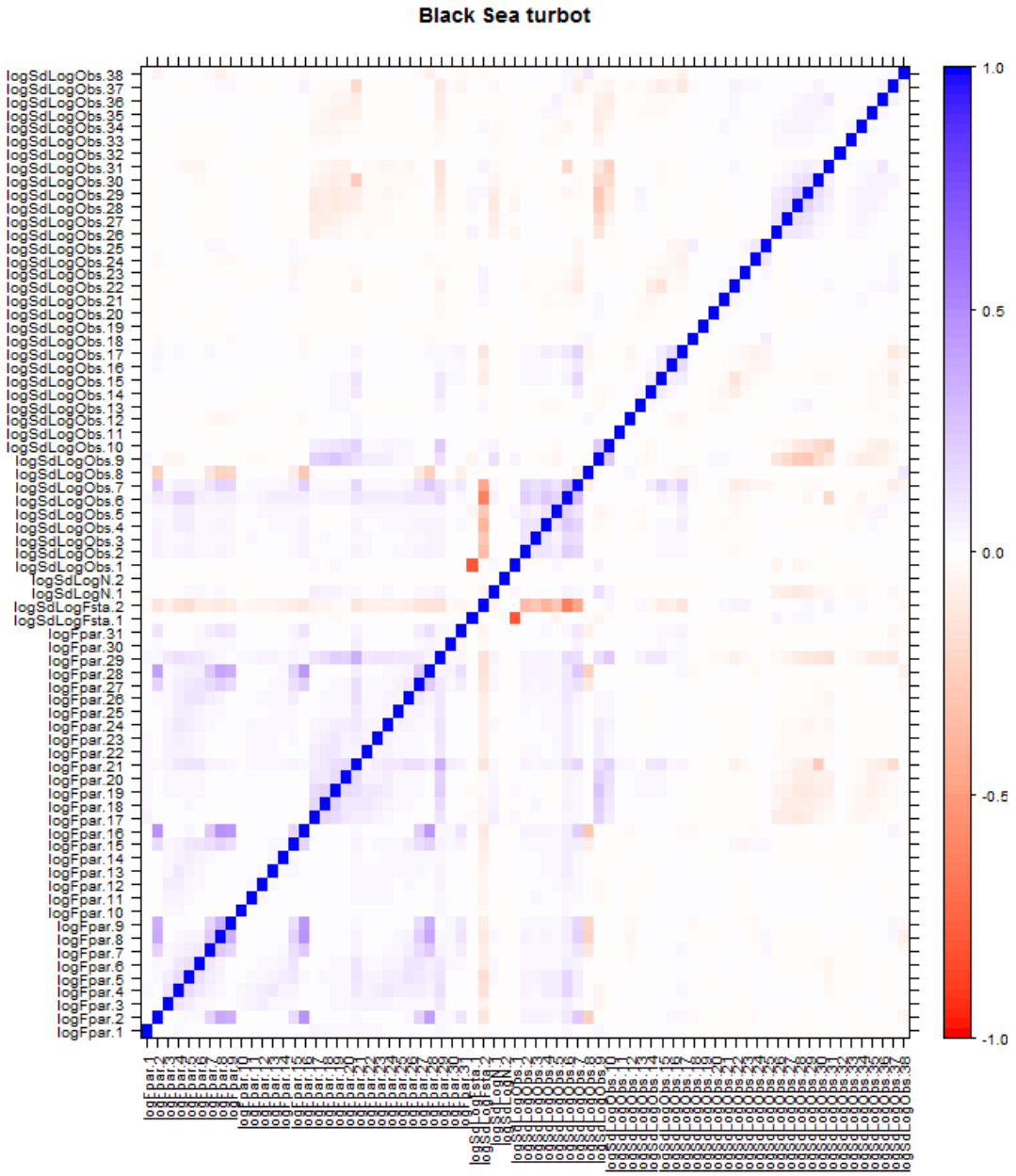
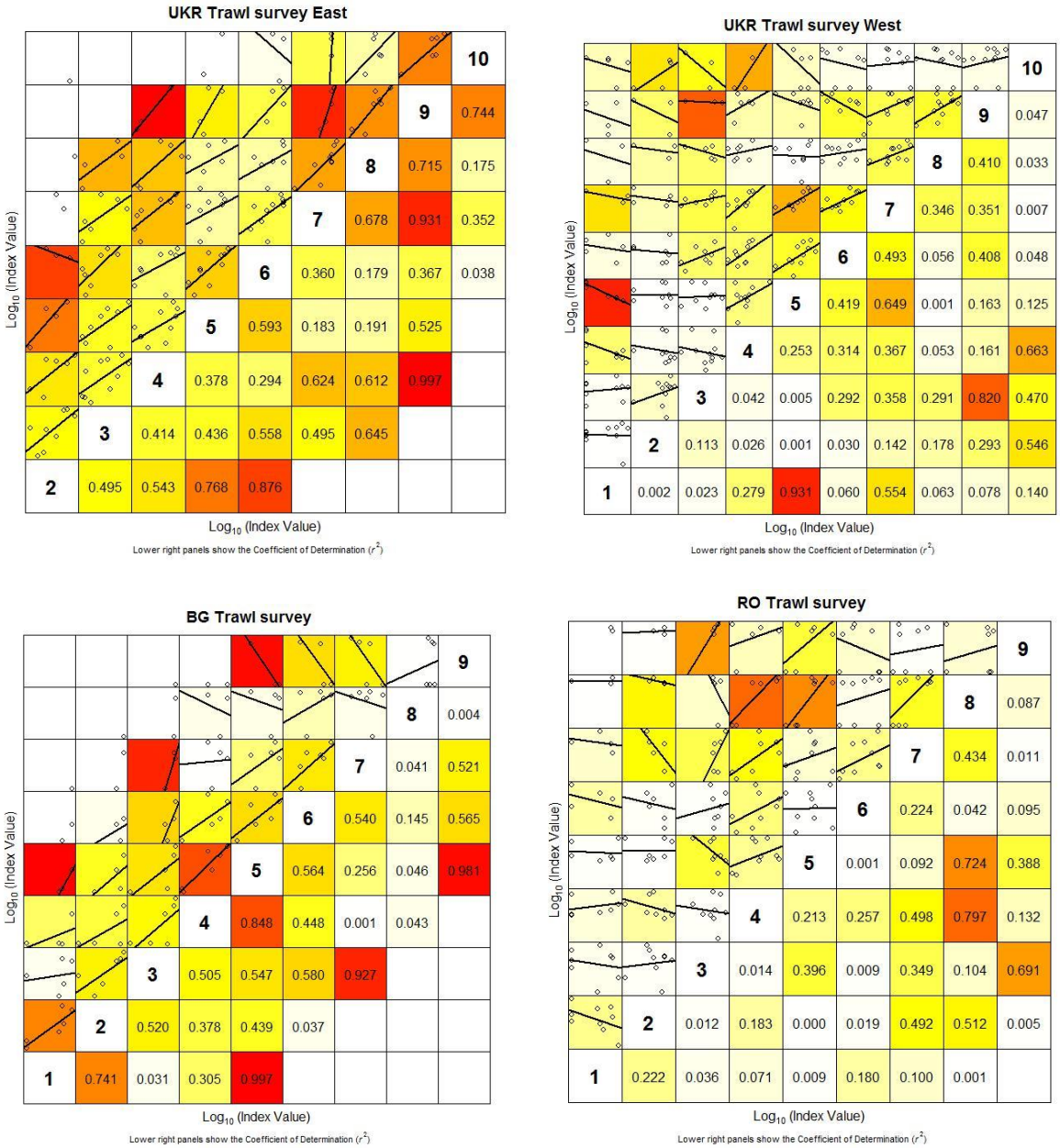


Figure 6.3-1. Black Sea turbot. Final run. Plot of all the estimat-ed parameters cross-correlation.

The catches have in general the smallest observation variance estimated with the exception of age 10+. These are followed by the different survey indices, with the ages 8-9 of the Romanian survey and the ages of the Ukrainian East survey as the less relevant surveys and

the Ukrainian West, the ages 6-7 of the Bulgarian and the ages 4-7 of the Romanian survey as the most relevant surveys for this assessment (Figure 6.3-2).



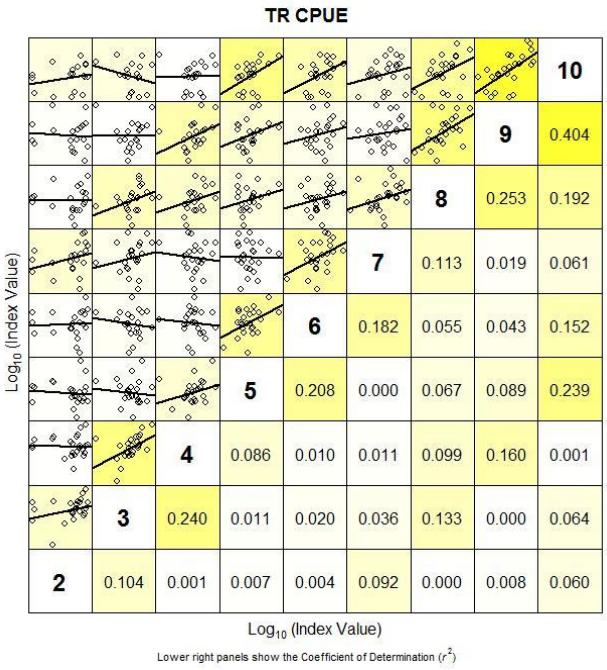


Figure 6.3-2. Fitted linear relationships of cohort trends (i.e. internal consistency) within the five tuning series used in the analysis.

7 Stock predictions

When an analytical assessment exists, predictions should be attempted. All scenarios tested (recruitment and/or fishing mortality) should be reported. The source of information/model used to predict recruitment should be documented.

7.1 Short term predictions

Qualitative assumptions about the IUU (Illegal, Unregulated and Unreported) fishing of turbot were made and the Potential Unreported Catch in 2012 was estimated. The estimates are considered to reflect the actual level of misreported catches of turbot in the Black Sea.

However, given the stock status, i.e. the F is more than 3 times higher than F_{msy} and the SSB is about one third of the estimated B_{lim}, the 2 short term projections for this stock were not undertaken.

7.2 Medium term predictions

Given the status of the stock, the medium term projections were not undertaken.

7.3 Long term predictions

Given the status of the stock, the long term projections were not undertaken.

8 Draft scientific advice

This section should provide with required text to explain the draft scientific advice, as well as tick a mark on the values in Table 8.1 and/or 8.2 that best represent the status of the stock.

Table 8-1: Unidimensional stock status (choose one)

Unidimnsional	**Not known or uncertain**. Not much information is available to make a judgment; **Underexploited, undeveloped or new fishery**. Believed to have a significant potential for expansion in total production; **Moderately exploited**, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production; **Fully exploited**. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion; **Overexploited**. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse; **Depleted**. Catches are well below historical levels, irrespective of the amount of fishing effort exerted; **Recovering**. Catches are again increasing after having been depleted or a collapse from a previous; **None** of the above.

Table 8-2: Bidimensional stock status

	Exploitation rate	**Stock Abundance**
Bidimensional	F_{msy}=0.26	B_{pa}=4080 B_{lim}=2914

Please note the two new definitions provided by the SAC:

> ***Overfished (or overexploited)*** *- A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like B0.1 or BMSY. To apply this denomination, it should be assumed that the current state of the stock (in biomass) arises from the application of excessive fishing pressure in previous years. This classification is independent of the current level of fishing mortality.*
>
> ***Stock subjected to overfishing (or overexploitation)*** *- A stock is subjected to overfishing if the fishing mortality applied to it exceeds the one it can sustainably stand, for a longer period. In other words, the current fishing mortality exceeds the fishing mortality that, if applied during*

a long period, under stable conditions, would lead the stock abundance to the reference point of the target abundance (either in terms of biomass or numbers)